PROJECT NUMBER: 1702
PROJECT TITLE: Optical Processing and Aerosol Research
PROJECT LEADER: K. A. Cox
PERIOD COVERED: April, 1989

I. PACK INSPECTION

A. **Objective**: Develop and implement a method for the on-line inspection of cigarette packs.

B. **Results**: Three enhancements to the inspection algorithm have been developed. First, a change has been made to represent the edge-enhanced images in a binary, bipolar format. Second, the image will be divided into a large number of segments (e.g., 256) and a discriminant filter applied to each segment. These two changes are expected to significantly increase the inspection capability of the system, allowing the detection of small blemishes which previously went undetected. Finally, a new centering algorithm has been developed which will allow more precise positioning of the image prior to the application of the discriminant filter. The new centering method is much more tolerant of the nature of the region chosen for carrying out the centering. The method is also expected to be useful for the off-line inspection of package blanks.

Approximately half of the images of Lark packs captured on video tape from a camera on an ITRAN system connected to a continuous conveyor were digitized with the Androx image computer.

C. **Plans**: Complete the digitization of the Lark pack images. Evaluate the capability of the inspection algorithm for inspecting the images.

II. CUT CLOSURE STAMP INSPECTION SYSTEM

A. **Objective**: Develop and implement a system for the off-line QA inspection of cut closure stamps.

B. **Results**: The computer program for the analysis of the cut closure stamp images has been written and debugged. This program allows the Sun microcomputer to control the stepper motor that turns the stamp handling system and capture images from the video camera. Tests indicate that the inspection system can correctly classify cut closure stamps. In one test 1004 stamps were inspected, including 5 stamps that were turned with their backs presented to the camera. All stamps were correctly classified with no misfeeds. Although the test was promising, other tests have shown that the stamp handling mechanism will occasionally feed two stamps at once. A circuit has been designed to detect this occurrence.

C. **Plans**: Complete the development of the stamp inspection system and evaluate it in the QA environment.

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III. INDIVIDUAL CIGARETTE INSPECTION

A. **Objective**: Develop methods for the on-line inspection of individual cigarettes.

B. **Results**: The AccuRay CIM was used to obtain characteristic curves for letters on a simulated cigarette rod. The ACRO 916 computer programs were modified to permit data grabbing to be triggered by the sample. The ACRO 916 limited viewing to just three output ports; however, the initial data demonstrate the feasibility of the data acquisition method.

C. **Plans**: Obtain characteristic curves for actual cigarette print.

IV. HIGH SPEED PRINT INSPECTION

A. **Objective**: Develop methods for the inspection of print on a printing press.

B. **Results**: For the inspection of print produced at very high rates, (greater than 200 images/sec), a self learning scheme by which the inspection system can learn adaptively is highly desirable. Such a scheme has the advantage of requiring minimal input from an operator, as well as being able to adjust for any gradual, acceptable changes in the image. The Widrow-Hoff adaptive learning algorithm has been successfully applied to the generation of a discriminant filter for the inspection of images of the Marlboro pack. The filter generated was found to be nearly identical to the filter generated earlier by our batch training procedure.

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